SYLLABUS

FOR

M.Sc. MEDICAL Microbiology (SEMESTER I & II)

(Under Choice based Credit System)

Examinations: 2021 Onwards

Board of Studies of Medical Laboratory Technology & Sciences

I K GUJRAL PUNJAB TECHNICAL UNIVERSITY KAPURTHALA

Note:

(i) Subject to change in the syllabi at any time. Please visit the University website time to time.

IK Gujral Punjab Technical University

VISION

To be an institution of excellence in the domain of higher technical education that serves as the fountainhead for nurturing the future leaders of technology and techno- innovation responsible for the techno-economic, social, cultural and environmental prosperity of the people of the State of Punjab, the Nation and the World.

MISSION

To provide seamless education through the pioneering use of technology, in partnership with industry and society with a view to promote research, discovery and entrepreneurship and To prepare its students to be responsible citizens of the world and the leaders of technology and techno-innovation of the 21st Century by developing in them the desirable knowledge, skill and attitudes base for the world of work and by instilling in them a culture for seamlessness in all facets of life.

OBJECTIVES

- To offer globally-relevant, industry-linked, research-focused, technology- enabled seamless education at the graduate, postgraduate and research levels in various areas of engineering & technology and applied sciences keeping in mind that the manpower so spawned is excellent in quality, is relevant to the global technological needs, is motivated to give its best and is committed to the growth of the Nation;
- To foster the creation of new and relevant technologies and to transfer them to industry for effective utilization;
- To participate in the planning and solving of engineering and managerial problems of relevance to global industry and to society at large by conducting basic and applied research in the areas of technologies. To develop and conduct continuing education programmes for practicing engineers and managers with a view to update their fundamental knowledge base and problem-solving capabilities in the various areas of core competence of the University;
- To develop strong collaborative and cooperative links with private and public sector industries and government user departments through various avenues such as undertaking

of consultancy projects, conducting of collaborative applied research projects, manpower development programmes in cutting-edge areas of technology, etc;

- To develop comprehensive linkages with premier academic and research institutions within the country and abroad for mutual benefit;
- To provide leadership in laboratory planning and in the development of instructional resource material in the conventional as well as in the audio- visual, the video and computer-based modes;
- To develop programmes for faculty growth and development both for its own faculty as well as for the faculty of other engineering and technology institutions;
- To anticipate the global technological needs and to plan and prepare to cater to them;
- To interact and participate with the community/society at large with a view to inculcate in them a feel for scientific and technological thought and endeavour; and
- To actively participate in the technological development of the State of Punjab through the undertaking of community development programmes including training and education programmes catering to the needs of the unorganized sector as well as that of the economically and socially weaker sections of society.

ACADEMIC PHILOSOPHY

The philosophy of the education to be imparted at the University is to awaken the **"deepest potential"** of its students as holistic human beings by nurturing qualities of self-confidence, courage, integrity, maturity, versatility of mind as well as a capacity to face the challenges of tomorrow so as to enable them to serve humanity and its highest values in the best possible way.

TITLE OF THE PROGRAM: M.Sc. MEDICAL Microbiology

YEAR OF IMPLIMENTATION: New Syllabus will be implemented from October, 2021 onwards.

DURATION: The course shall be two years, with semester system (4 semesters, with two semesters in a year). The Choice based credit system will be applicable to all the semesters.

ELGIBILITY FOR ADMISSION: Candidates with 50% marks (5% relaxation for reserved categories) in Bachelors Degree in Medical/B.Sc. (Hons.) in Microbiology/ B.Sc. MLT are eligible for admission to this course.

INTAKE CAPACITY: 30 (Thirty)
MEDIUM OF INSTRUCTION: English.

SCHEME OF THE PROGRAM: Semester-I

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
MMB-101-21	Core theory	Human Anatomy and Physiology	3	1	--	30	70	100	4
MMB-102-21	Core theory	Clinical Microbiology	3	1	0	30	70	100	4
MMB-103-21	Core theory	Clinical Biochemistry	3	1	0	30	70	100	4
MMB-104-21	Core theory	Immunology	3	1	0	30	70	100	4
MMB-105-21	Core Practical/Laboratory	Human Anatomy and Physiology Lab	0	0	6	25	50	75	3
MMB-106-21	Core practical/ laboratory	Clinical Microbiology Lab	0	0	6	25	50	75	3
MMB-107-21	Core practical/ laboratory	Clinical Biochemistry Lab	0	0	6	25	50	75	3
MMB-108-21	Elective practical	Seminar/Presentations	0	0	1	-	-	25	1
	TOTAL					195	430	650	26

SECOND SEMESTER M.Sc. Medical Microbiology

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
MMB-201-21	Core theory	Systemic bacteriology	4	0	0	30	70	100	4
MMB-202-21	Core theory	Hematology	3	1	0	30	70	100	4
MMB-203-21	Core theory	Medical biotechniques	3	1	0	30	70	100	4
MMB-204-21	Core theory	Elements of Molecular biology	3	1	0	30	70	100	4
MMB-205-21	Elective theory	Parasitology	3	0	0	30	70	100	3
MMB-206-21	Core practical/ laboratory	Systemic bacteriology laboratory	0	0	4	25	75	100	2
MMB-207-21	Core practical/ laboratory	Medical biotechniques laboraory	0	0	4	25	75	100	2
MMB-208-21	Core practical/ laboratory	Hematology laboratory	0	0	2	25	75	100	1
MMB-209-21	Elective practical	Seminar/ workshops	0	0	2	---	---	100	1
	TOTAL		16	3	12	225	575	900	25

EXAMINATION AND EVALUATION

THEORY				
S.No.		Weightage in Marks		Remarks
1	Mid-Semester Examination	20	15	MSTs, Quizzes, assignments, attendance, etc. Constitute internal evaluation. Average of two mid-semester exams will be considered for evaluation
2	Attendance	5	5	
3	Assignments	5	5	
4	End-Semester Examination	70	50	Conduct and checking of the answer sheets will be at the department level in case of university teaching department of Autonomous institutions. For affiliated colleges examination will be conducted at the university level
	Total	**100**	**75**	
PRACTICAL				
1	Daily evaluation of practical performance/ record/ viva voce	30		Internal Evaluation
2	Attendance	5		
3	Internal Practical Examination	15		
4	Final Practical Examination	25		External Evaluation
	Total	**75**		

PATTERN OF END-SEMESTER EXAMINATION

I. **Part A** will be One Compulsory question consisting of short answer type questions [Q No. 1(a-j)] covering whole syllabus. There will be no choice in this question. It will be of 20 marks comprising of **10 questions of 2 marks each**.

II. **Part B** will be comprising of eight questions [2-9]. Student will have to attempt any six questions from this part. It will be of 30 marks with **6 questions of 5 marks each**.

III. **Part C** will be comprising of two compulsory questions with internal choice in both these questions [10-11]. It will be of 20 marks with **2 questions of 10 marks each**.

SYLLABUS OF THE PROGRAM

The syllabus has been upgraded as per provision of the UGC module and demand of the academic environment. The contents of the syllabus have been duly arranged unit wise and included in such a manner so that due importance is given to requisite intellectual and laboratory skills. The application part of the respective contents has been appropriately emphasized.

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**M.Sc. Medical Microbiology**			
Subject Code	**MMB 101-21**			
Subject Title	**Human Anatomy & Physiology**			
Contact Hours	**L:4**	**T:0**	**P:0**	**Credits:4**
Examination Duration (Hrs)	**3**			
Objective	**To teach basic concepts of Human Anatomy & Physiology**			

Course Contents

UNIT	CONTENTS	HOURS
I	**INTODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY** Structural organisation of human body, homeostasis, directional and regional terms of human anatomy and physiology, body planes, cavities and regions. **DIGESTIVE SYSTEM** Structure and functions of the organs of digestive system, gastrintestinal glands, enzymes of digestive system, mechanism of digestion in gastrointestinal/digestive system **RESPIRATORY SYSTEM** Structure and functions of respiratory organs, respiratory volumes and capacities, mechanism of breathing and exchange of gases	15
II	**CARDIOVASCULAR SYSTEM** Blood composition, structure and function of heart and major blood vessels of human body, blood circulation pathway, pulmonary circulation, general and systematic circulation, conductive system of heart, cardiac cycle, ECG **ENDOCRINE SYSTEM** Location of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, hypothalamus, pancreatic iselets, pineal and thymus gland, structure and function of all human glands.	12
III	**MUSCULAR SYSTEM** Structure of different types of muscles in human body, mechanism of muscle contraction, neuromuscular transmission **SKELETAL SYSTEM** Classification, structure and function of human skeletal system, microanatomical and gross structureof a bone, tupes and developments of bones, movement and types of bone joints in human body	12
IV	**NERVOUS SYSTEM** Location of brain and spinal cord, structure and function of brain and spinal cord, details of central nervous system, peripheral nervous system and autonomous nervous system, structure of neuron, synapse,transmission and conduction of nerve impulse **URINOGENITAL SYSTEM** Structure and functions of organs of urinary system, structure and function of nephron, mechanism of urine formation, micturition, structure and function of male and female reproductive system, menstrual cycle, infertility and menopause, fertulisation and embryogenesis	15

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	Ross & Wilson Anatomy and Physiology	Anne Waugh, Allison Grant	Churchill Livingstone
2	Principles of Anatomy & Physiology	Tortora & Bryan	WILEY
3	Kathleen J.W. Wilson	Anatomy and Physiology in Health and Illness	Churchill Livingstone, New York
4	Arthur C,Guyton and John.E	Text book of Medical Physiology	Hall. Miamisburg, OH, U.S.A

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**M.Sc. Medical Microbiology**			
Subject Code	**MMB 102-21**			
Subject Title	**Clinical Biochemistry**			
Contact Hours	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (Hrs)	**3**			
Objective	**To teach basic concepts of Clinical Biochemistry**			

Details of the Course

UNIT	CONTENTS	HOURS
I	**INTRODUCTION TO BIOMOLECULES** Introduction to carbohydrates, proteins and lipids and their functions, metabolic reactions of carbohydrates, lipids and proteins	8
II	**LIVER FUNCTION TESTS** Introduction and functions of liver, metabolic and excretory functions, protection and detoxification, liver profile test: serum bilirubin and VD Bergh reaction, serum transaminases, alkaline phosphatase, gamma-glutamyl transferase, principle and clinical importance of liver markers **KIDNEY FUCTION TESTS** Introduction and function of kidney, excretory and reabsorptive functions, regulatory functions, urine formation, diseases of kidney, kidney profile test: blood urea nitrogen, serum creatinine, total protein, albumins, globulins, A/G ratio, clearance tests, urine examination	12
III	**MALNUTRITIONAL DISORDERS** Marasmus, kwashiorkor, nutritional deficiency of vitamins & minerals, prescribed diet, hyper vitaminosis and hypo vitaminosis **CANCER** Etiology of cancer, biochemical changes of cancer, role of oncogenes, apoptosis, biochemical basis of metastasis	12
IV	**BIOCHEMICAL CHANGES AND DISEASES** Biochemistry of diabetes mellitus, fatty liver and biochemical changes, atherosclerosis and biochemical changes **INBORN ERRORS BY BIOCHEMICAL METABOLISM** Inborn errors of carbohydrate metabolism: glycogen storage disease, essential pentosuria, fructosuria, galactosemia, inborn errors of protein and amino acid metabolism: phenyl ketonuria, alkeptonuria, albinism, cystinuria, hypertyrosinemias, homocystinuria, inborn errors of lipid metabolism: Gaucher's disease, Fabry's disease, Taysach's disease, Niemann pick disease	12

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	CHATTERJEA M N AND SHINDE RANA	TEXTBOOK OF MEDICAL BIOCHEMISTRY	JAYPEE BROTHERS MEDICAL PUBLISHERS PVT. LTD
2	GODKAR P.B AND GODKAR D.P,	TEXTBOOK OF MEDICAL BIOCHEMISTRY	BHALANI PUBLISHING HOUSE
3.	DEVLIN, T.M.	TEXTBOOK OF BIOCHEMISTRY WITH CLINICAL CORRELATIONS	JOHN WILEY & SONS, INC. (NEW YORK),
4.	NELSON, D.L. AND COX, M.M	LEHNINGER: PRINCIPLES OF BIOCHEMISTRY	W.H. FREEMAN AND COMPANY (NEW YORK)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**M.Sc. Medical Microbiology**			
Subject Code	**MMB 103-21**			
Subject Title	**Clinical Microbiology**			
Contact Hours	**L:4**	**T:0**	**P:0**	**Credits:4**
Examination Duration (Hrs)	**3**			
Objective	**To teach basic concepts of Clinical Microbiology**			

Details of the Course

UNIT	CONTENTS	HOURS
I	**INTRODUCTION, HISTORY & SCOPE OF MICROBIOLOGY** Introduction and history & developments of microbiology, scope of microbiology, general characteristics of prokaryotes and eukaryotes, classification of prokaryotes, introduction to mycology, virology and parasitology **STRUCTURE OF BACTERIAL CELL** structure and functions of gram positive and gram negative bacteria, cell wall, cell membrane, cytoplasmic inclusions and mesosomes, flagella, capsule, ribosome, chromosome, plasmid and endospore, morphological classification of bacteria	8
II	**MICROSCOPY** Definition,Importance of microscopy, principle, operation and applications of light microscope, phase contrast microscopy, fluorescence microscopy, electron microscopy **STERILIZATION AND DISINFECTION** Introduction and its types, principle,procedure and its application, definition and types of disinfectant, quality control for sterilization and disinfection, biosafety in microbiology lab, biowaste management	12
III	**CHEMOTHERAPY AND CHEMOTHERAPEUTIC AGENTS** Introduction, types of chemotherapeutic agents, mode of action and clinical importance of different chemotherapeutic agents, antibiotic sensitivity tests and its medical importance, introduction,types,mode of action and importance of multiple drugs resistance, mechanism of drug resistance **NORMAL MICROBIAL FLORA AND PATHOGENIC MICROORGANISMS** Normal microbial flora of the human body, collection and transport of specimens, processing of clinical specimens for microbiological examination **MICROBIAL NUTRITION AND GROWTH** Growth kinetics, different types of culture medium, continuous culture and synchronous growth cultures, aerobic & anaerobic cultures, Introduction and its types, various affecting factors on microbial growth	15
IV	**NOSOCOMIAL INFECTIONS** Introduction and its types, pathogenicity and laboratory diagnosis of nosocomial infection, prevention and control of nosocomial infections **ENVIRONMENTAL MICROBIOLOGY** Bacteriology of air, water, food, milk, soil	12

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	TORTORA, G.J., FUNKE, B.R., AND CASE, C.L	MICROBIOLOGY: AN INTRODUCTION	BENJAMIN/CUMMINGS PUBLISHING COMPANY, INC.
2	PELCZAR, M.T.	MICROBIOLOGY	TATA MCGRAW HILL PUBLICATION, NEW DELHI.
3.	SCHEGEL, H.G	GENERAL MICROBIOLOGY	CAMBRIDGE UNIVERSITY PRESS
4.	STANIER, R.Y.	GENERAL MICROBIOLOGY	MACMILLIAN PRESS LONDON.

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**M.Sc. Medical Microbiology**			
Subject Code	**MMB 104-21**			
Subject Title	**Immunology**			
Contact Hours	**L:4**	**T:0**	**P:0**	**Credits:4**
Examination Duration (Hrs)	**3**			
Objective	**To teach basic concepts of Immunology**			

Details of the Course

UNIT	CONTENTS	HOURS
I	**INTRODUCTION TO IMMUNE SYSTEM** Introduction and overview of different types of immunity: innate and adaptive immunity, primary and secondary lymphoid tissues and organs, cells of immune system **ANTIGENS** Factors responsible for immunogenicity, immunogen, hapten and adjuvants, epitopes, heterophile antigen, super antigen. **ANTIBODIES** Structure and function of immunoglobulins, monoclonal antibodies, immunoglobulin genes, generation of antibody diversity, immunoglobulin superfamily **ANTIGEN & ANTIBODY REACTIONS** Molecular mechanism of antigen - antibody binding, precipitation and agglutination reaction, immunoelectrophoresis and immunofluorescence, ELISA and Western blotting.	15
II	**MHC** Structure of MHC molecules, MHC and peptide interaction, antigen processing and presentation, transplantation rejection, HLA complex in human **B CELL &T CELL ACTIVATION** BCR and TCR, cell interactions in antibody response, B cell activation, synthesis and secretion of immunoglobulin's, T cell maturation, activation and differentiation	12
III	**CYTOKINES** Common properties of cytokines and cytokine types, biological activities of cytokines, pro-inflammatory cytokines, cytokine diseases and therapies **HUMORAL & CELL-MEDIATED EFFECTOR RESPONSES** Immune responses to infection, leukocyte recirculation and inflammation, neutralization, opsonisation and ADCC, vaccines	12
IV	**AUTOIMMUNITY AND TOLERANCE** Mechanism of self tolerance, immune deficiency diseases, hypersensitivity reactions, AIDS, cancer and the immune system **COMPLEMENT SYSTEM** Introduction to complement system, classical, alternative and lectin complement pathway, biological effect of complement system, regulation of complement system	12

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	KINDT, T.L., GOLDSBY, R.A. AND OSBORNE, B.A	KUBY IMMUNOLOGY	W.H FREEMAN AND COMPANY (NEW YORK)
2	COICO, R AND SUNSHINE, G	IMMUNOLOGY: A SHORT COURSE	JOHN WILEY& SONS, INC (NEW JERSEY)
3.	MURPHY, K., MOWAT, A., AND WEAVER, C.T	JANEWAY'S IMMUNOBIOLOGY	GARLAND SCIENCE (LONDON & NEW YORK)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**M.Sc. Medical Microbiology**			
Subject Code	**MMB 105-21**			
Subject Title	**Human Anatomy & Physiology Lab**			
Contact Hours	**L:0**	**T:0**	**P:6**	**Credits:3**
Examination Duration (Hrs)	**3**			
Objective	**To learn the basic skills and practical knowledge of Human Anatomy & Physiology**			

Details of the Course

CONTENTS
1. Demonstration of parts of circulatory system from models. 2. Demonstration of parts of respiratory system from models. 3. Demonstration of digestive system from models. 4. Demonstration of nervous system from models. 5. Demonstration of Excretory System from Models. 6. Structure of human heart. 7. Demonstration of various parts of male & female reproductive system from models

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**M.Sc. Medical Microbiology**			
Subject Code	**MMB 106-21**			
Subject Title	**Clinical Microbiology Lab**			
Contact Hours	**L:0**	**T:0**	**P:6**	**Credits:3**
Examination Duration (Hrs)	**3**			
Objective	**To learn the basic skills and practical knowledge of Clinical Microbiology**			

Details of the Course

CONTENTS
Simple staining of bacteria • To prepare bacterial smear and perform simple staining using methylene blue **Gram staining** • To perform Gram staining of different bacterial cultures **Special stain** • To perform endospore staining, acid-fast staining and Albert's staining of bacterial cultures **Counting of bacterial cell** • To perform viable count of bacteria using pour plating technique **Effect of nutritional factors on growth** • To study the effect of different carbon & nitrogen sources on the growth of microorganisms **Effect of environmental factors on growth** • To study the effect of pH on the growth of microorganisms • To study the effects of UV radiation on growth of microorganisms **Bacteriological examination of water & milk** • To perform the bacteriological examination of water and milk • To perform the bacteriological examination of milk by methylene reductase test **Microbes in hospital environment** • To isolate and identify the bacteria and fungi from hospital environment

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**M.Sc. Medical Microbiology**			
Subject Code	**MMB 107-21**			
Subject Title	**Clinical Biochemistry Lab**			
Contact Hours	**L:0**	**T:0**	**P:6**	**Credits:3**
Examination Duration (Hrs)	**3**			
Objective	**To learn the basic skills and practical knowledge of Clinical Biochemistry**			

Details of the Course

CONTENTS
Qualitative analysis of biomolecules • Qualitative test for carbohydrates: Molisch Test, Benedict test • Qualitative test for amino acid and protein: Biuret test, Ninhydrin test • Qualitative test for lipid: Acrolein test **Quantitative analysis of blood parameters 1** • Quantitative estimation of blood cholesterol • Quantitative estimation of blood glucose • Quantitative estimation of blood urea **Quantitative analysis of blood parameters 2** • Quantitative estimation of creatinine • Quantitative estimation of protein albumin • Quantitative estimation of uric acid **Quantitative analysis of liver enzymatic markers** • Quantitative estimation of SGPT • Quantitative estimation of ALP **Quantitative analysis of heart enzymatic marker** • Quantitative estimation of SGOT a cardiac marker **Quantitative analysis of prostate gland enzymatic marker** • Quantitative estimation of ACP

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 201-21**
Subject Title	**Systemic Bacteriology**
Objective	**To teach basic concepts of Systemic Bacteriology**

Course Contents

UNIT	CONTENTS	HOURS
I	**Epidemiology and control of community infections:** Study of normal flora of human body, control and prevention of community, Epidemiological markers, different carries and sources of infection. **Gram positive cocci and bacilli:** A detailed account of morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Staphylococcus, Streptococcus, Pneumococcus, Corynebacterium, Bacillus and Clostridium.	10
II	**Acid fast bacteria and Gram-negative cocci:** A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Mycobacterium tuberculosis and Mycobacterium leprae, Neisseria **Gram negative bacilli**: A detailed account of cultural and Morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Pseudomonas aeruginosa and Vibrio, Hemophilus influenzae and Campylobacter jejune, Bordetella pertussis and Yersinia pestis, Bacteroides and Helicobacter pylori	8
III	**Enterobacteriaceae**: A detailed account of cultural and Morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Enterobacteriaceae family like E. coli, Klebsiella, Shigella, Salmonella, Proteus, Acinetobacter, Hafnia, Enterobacter, Serratia marcescens and Citrobacter	10
IV	**Miscellaneous bacteria**: A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Actinomycetes (Actinomyces and Nocardia) and Spirochaetes (Treponema, Borrelia, Leptospira), Brucellae, Listeria, Monocytogenes, Mycoplasma, Rickettsia, Ehrlichia, Chlamydiae, Moraxella catarrhalis	8

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	ANANTHANARAYAN R. AND PANIKER C. K. J	TEXTBOOK OF MICROBIOLOGY	UNIVERSITIES PRESS PVT. LTD
2	PANJARATHINAM R	MEDICAL MICROBIOLOGY	NEW AGE INTERNATIONAL

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 202-21**
Subject Title	**Hematology**
Objective	**To teach basic concepts of Hematology**

Details of the Course

UNIT	CONTENTS	HOURS
I	**Introduction to hematology and anticoagulants:** Introduction to hematology, naturally occurring anticoagulants, commonly used anticoagulants EDTA, citrates, oxalates, heparin anticoagulants and their mode of action. **Blood and its composition:** Plasma and cellular composition of blood, formation of blood - erythropoiesis, leucopoiesis, thrombopoiesis, morphology of normal blood cells.	10
II	**Routine hematological tests:** Methods, principle, procedure, normal values and clinical significance of hemoglobin, total leucocyte count, red blood cell count, differential leucocyte count, erythrocyte sedimentation rate, packed cell volume, red cell indices **Cytochemical stains:** introduction, myeloperoxidase, periodic acid Schiff's, Sudan black, specific and non-specific esterase stains, and stain for neutrophil alkaline phosphatase activity.	10
III	**Hematology Laboratory Automation:** introduction, types, principle, working and maintenance of cell counters, hemoglobin analyzer, hematocrit analyzer, reticulocyte and platelets analyzer, automated digital analysis of cells, coagulometer, and ESR analyzer	6
IV	**Disorders of red blood cells:** introduction to anemia, classification – morphological and etiological classification of red blood cells, clinical features, pathophysiology, laboratory investigations of, iron deficiency anemia, megaloblastic anemia, hemolytic anemia. Brief introduction to thalassemia's. **Disorders of white blood cells:** Introduction, classification - French American and British- FAB classification, pathophysiology, clinical features, Lab investigations, leukemoid reaction **Hemorrhagic disorders:** Hemostasis mechanism, pathogenesis, clinical feature, classification of, vascular disorders, platelet disorders, coagulation disorders	10

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	MUKHERJEE K.L	MEDICAL LABORATORY TECHNOLOGY: PROCEDURE MANUAL FOR ROUTINE DIAGNOSTIC TESTS, VOL I	MCGRAW HILL EDUCATION
2	BAIN & BATES &	DACIE AND LEWIS PRACTICAL	

	LAFFAN & LEWIS, CHURCHILL LIVINGSTONE	HAEMATOLOGY	

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 203-21**
Subject Title	**Medical Biotechniques**
Objective	**To teach basic concepts of Medical Biotechniques**

Course Contents

UNIT	CONTENTS	HOURS
I	**Centrifugation techniques:** Theory and principle of centrifugation, centrifuges and their uses, preparative and analytical centrifugation, rotors types and safety aspects of centrifugation. **Electrophoretic techniques:** Theory and application of electrophoresis, polyacrylamide gel electrophoresis, isoelectric focusing, capillary electrophoresis, 2D gel electrophoresis.	12
II	**Spectrophotometric techniques:** Electromagnetic radiations, theory and applications of UV-vis, infrared, fluorescence and atomic absorption spectrophotometry. **Spectroscopy techniques:** Electro spin resonance (ESR), Nuclear Magnetic resonance (NMR) spectroscopy, mass spectroscopy (MS). **Microscopy:** Theory and principles of microscopy, light, dark field, fluorescent, UV microscopy, TEM, SEM, confocal microscopy, flow cytometry, phase contract microscopy	12
III	**Chromatography:** Separation of biomolecules: chromatographic Techniques: principles and applications of column, thin-layer, paper chromatography, ion-exchange and affinity chromatography, high performance liquid chromatography (HPLC), and gas chromatography (GC).	8
IV	**Radioisotope techniques:** Radioactivity and radioisotopes, detection and measurement of radioactivity and Cerenkov counting, applications in biological sciences - analytical, diagnostics and metabolic studies, safety aspects of radioactive handling.	8

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	KEITH WILSON & JOHN WALKER (EDS.)	PRINCIPLES AND TECHNIQUES OF BIOCHEMISTRY AND MOLECULAR BIOLOGY	CAMBRIDGE UNIVERSITY PRESS
2	S.V.S. RANA	BIOTECHNIQUES THEORY AND PRACTICE	RASTOGI PUBLICATIONS

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 204-21**
Subject Title	**Elements of Molecular Biology**
Objective	**To teach basic concepts of Molecular Biology**

Course Contents

UNIT	CONTENTS	HOURS
I	**Molecular basis of heredity:** central dogma, structure of DNA & RNA, denaturation and renaturation of DNA, genetic code, Wobble hypothesis **DNA replication:** components, mechanism, unidirectional and Bidirectional replication, rolling circle mechanism of replication **DNA damage and repair:** types of DNA damages (alkylation, De-amination, pyrimidine dimmers), repair mechanisms (light dependent repair, methyl-directed mismatch repair, nucleotide excision repair, post-replication repair, SOS repair)	10
II	**Genetic variability:** mutations- types of mutations (spontaneous, induced, forward, backward, suppressor, point and frame shift), chemical mutagens- base analogues, nitrous acid, acridines, alkylating and hydroxylating agents, biochemical basis of mutations & genetic mechanism of drug resistance **Genetic recombination in bacteria:** types of plasmids- F-plasmid, R plasmid, colplasmid, Ti-plasmid, transformation, conjugation, Transduction	10
III	**Transcription:** prokaryotic transcription, transcription cycle (initiation, elongation and termination), bacterial promoters and regulating factors, rho dependent and rho independent terminations, eukaryotic transcription- RNA polymerases, transcription factors, processing of mRNA in eukaryotes. Differences between Eukaryotic from prokaryotic transcription.	6
IV	**Translation:** initiation of translation, elongation and termination of translation (both prokaryotic and eukaryotic) **Regulation of gene expression:** operon concept, lac operon- positive control and negative control, trp operon- repressible regulation and attenuator regulation	10

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	K.G.RAMAWAT AND S. GOYAL	MOLECULAR BIOLOGY AND BIOTECHNOLOGY	S. CHAND & COMPANY
	D. L. NELSON AND M. M.	LEHNINGER PRINCIPLES OF	W. H. FREEMAN AND

2	COX	BIOCHEMISTRY	COMPANY

I.K. Gujral Punjab Technical University, Kapurthala

M.Sc. Medical Microbiology, Choice Based Credit System, Batch 2021 and onwards

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 205-21**
Subject Title	**Parasitology**
Objective	**To teach basic concepts of Parasitology**

Course Contents

UNIT	CONTENTS	HOURS
I	**Introduction to medical parasitology:** Classification of parasites, host-parasite relationships, routes of infection, effect of parasites on organs and tissues, host response to parasite infections, zoonoses **Identification of parasites in stool**: Gross examination of stool, microscopic examination for presence pf parasites, concentration methods	10
II	**Protozoan parasites**: Morphology, life cycle, pathogenesis and lab diagnosis of Entamoeba histolytica, Giardia lamblia, Trichomonas vaginalis, Trypanosoma brucei gambiense, Leishmania donovani Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae, Plasmodium ovale, Toxoplasma gondii, Cryptosporidium parvum	10
III	**Cestodes** : Morphology, life cycle, pathogenesis and laboratory diagnosis of Taenia solium, Taenia saginata, Echinococcus granulosis, Hymenolepis nana **Trematodes** : Morphology, life cycle, pathogenesis and laboratory diagnosis of Schistosoma mansoni, Schistosoma haematobium, Paragonimus westermanni, Fascioloa hepatica	8
IV	**Nematode-I** : Morphology, life cycle, pathogenesis and lab diagnosis of Ascaris lumbricoides, Ancyclostoma duodenale, Trichinella spiralis **Nematode-II** : Morphology, life cycle, pathogenesis and lab diagnosis of Enterobius vermicularis, Wuchereria bancrofti, Brugia malayi, Strongyloides stercoralis	8

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	APURBA SANKAR SASTRY AND SANDHYA BHAT	ESSENTIALS OF MEDICAL PARASITOLOGY	JAYPEE BROTHERS MEDICAL PUBLISHERS PVT. LTD
2	ARORA DR AND ARORA BB	MEDICAL PARASITOLOGY	CBS PUBLISHERS & DISTRIBUTORS PVT. LTD.

M.Sc. Medical Microbiology, Choice Based Credit System, Batch 2021 and onwards

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 206-21**
Subject Title	**Systemic Bacteriology Lab**
Objective	**To learn the basic skills and practical knowledge of Systemic Bacteriology**

Details of the Course

CONTENTS

1. Skin/pus /wound pathogens:
- Isolation and identification of microbes from skin/pus/wound

2. Blood pathogens:
- Isolation and identification of microorganisms from blood sample

3. Pathogens in urine:
- Isolation and identification of microorganisms from urine sample

4. Upper respiratory tract:
- Isolation and identification of microorganisms from throat

5. Lower respiratory tract:
- Isolation and identification of microorganisms from sputum sample.

6. Air-borne pathogens:
- Bacteriological examination of pathogens present in air

7. Antimicrobial susceptibility testing :
- Antimicrobial susceptibility testing by Kirby Bauer disc diffusion method

8. Determination of MIC and MBC :
- Determination of Minimum Inhibitory Concentration(MIC) and Minimum Bactericidal Concentration (MBC).

9. Microbial flora of the mouth :
- To isolate and identify microbial flora of mouth teeth crevices, Determination of dental caries susceptibility

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 207-21**
Subject Title	**Medical Bio techniques Lab**
Objective	**To learn the basic skills and practical knowledge of Medical Bio techniques**

Details of the Course

CONTENTS

1. Spectrophotometry:

- Demonstration of Beer-Lambert's law using UV-vis spectrophotometer

2. **Microscopy:**

- To demonstrate the principles of bright field microscopy using a bacterial culture.

3. Chromatography techniques:

- To separate different chlorophyll pigments using paper chromatography,
- To analyze a given sample for various amino acids using thin layer chromatography (TLC),
- To analyze a microbial extract for the presence of high value compounds using column chromatography.

4. Electrophoretic techniques:

- Separation of various proteins from a given microbial extract using Poly acrylamide gel electrophoresis (PAGE).

5. Molecular biology techniques:

- To perform isolation of plasmid DNA from a given E. coli strain,
- Quantification of the isolated DNA.
- To determine the molecular weight of a given DNA sample using agarose gel electrophoresis

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 208-21**
Subject Title	**Hematology Lab**
Objective	**To learn the basic skills and practical knowledge of Hematology**

Details of the Course

CONTENTS
1. Hemoglobin estimation. • Estimation of Hb by Sahli's method and cyanmethahaemoglobin method. **2. Total leucocyte count** • Estimation of total leukocytes count. **3. Differential leucocyte count** • Preparation blood smear, staining and differential leukocytes count. **4. Platelet count** • Determination of platelets count. **5. Red cell count** • Determination of red cell count. **6. Reticulocyte count and RCI.** • Determination of rectics count and red cell indices. **7. Absolute Eosinophil count** • Determination of absolute eosinophil count. **8. Plasma hemoglobin** • Estimation of plasma hemoglobin. **9. Coagulation disorders test** • Estimation of PT & PTTK. **10. Myeloperoxidase stain** • To prepare and perform the myelo-peroxidase stain **11. PAS stain** • To prepare and perform the PAS stain **12. Erythrocyte sedimentation rate** • To perform ESR by Wintrobe's and Westergren's method. **13. Packed cell volume** • To perform packed cell volume **14. Hemolytic anemia** • To perform red cell osmotic fragility test

I.K. Gujral Punjab Technical University, Kapurthala

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 301-21**
Subject Title	**Virology and Mycology**
Objective	**To teach basic concepts of Virology and Mycology**
Examination Hours (Duration)	**3 Hours**

Course Contents

UNIT	CONTENTS	HOURS
I	**General Properties of Viruses** : Origin of virology, properties of viruses, classification and nomenclature of viruses, structure of viruses, capsid symmetry and architecture **Cultivation and Purification of Viruses** : Cultivation, isolation, purification and virus assays, virus receptors, interaction with host cell, attachment and penetration, uncoating and replication, lysogenic and lytic bacteriophages, lysogeny with special reference to lambda and mu phages.	10
II	**DNA & RNA viruses** : Transmission of viruses, epidemiology of viral infection, prevention and control measures of viral infection, molecular techniques for clinical diagnosis of viral diseases **Pathogenicity, medical features, laboratory diagnosis, immunoprophylaxis and prophylaxis** : Dengue, Japanese encephalitis, Yellow fever, Kyasanur forest disease, Polio, Influenza virus, Rubella virus, Hepatitis, HIV, Smallpox, Rabies, Rotavirus and Oncovirus	8
III	**Introduction to medical mycology** : Introduction and classification of fungi, media used for culturing fungi, chemotherapeutic agents for fungi, mechanism of resistance of chemotherapeutic agents **Pathogenicity,clinical features and laboratory diagnosis of superficial and subcutaneous mycosis** : Dermatophytoses, Piedra, Tinea nigra, Tinea versicolor, chromoblastomycosis, mycetoma, sporotrichosis and rhinosporidiosis**.**	10
IV	**Pathogenicity, medical features and laboratory diagnosis of systemic and opportunistic mycosis** : Paracoccidioidomycosis, coccidiodomycosis, histoplasmosis, blastomycosis, cryptococcosis candidiasis, aspergillosis, penicillosis **Molecular techniques** : Recent molecular techniques used for the diagnosis of fungal infection	8

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	ANANTHANARAYAN R. AND PANIKER C. K. J	TEXTBOOK OF MICROBIOLOGY	UNIVERSITIES PRESS PVT. LTD
	ALEXOPOLUS C J, MIMS CHARLES W AND	INTRODUCTORY MYCOLOGY	WILEY INDIA PVT. LTD.

2	BLACKWELL M, JAMES WILSON & SON		

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 302-21**
Subject Title	**Biostatistics**
Objective	**To teach basic concepts of Biostatistics**

Details of the Course

UNIT	CONTENTS	HOURS
I	**Introduction to biostatistics and descriptive statistics**: Introduction, biological variations and uncertainties, role of statistics, Variables, variations and distributions	8
II	**Correlation and Regression** : Association between variables, positive and negative correlation, linear and non-linear correlation, Linear and non-linear regression, regression analysis.	8
III	**Testing of hypothesis** : Student's t-test, chi-square test, F-test and Fisher's z- test, one way ANOVA, two way ANOVA **Elements of probability** : Introduction, independent and non-independent event, law of additivity, multiplication law of probability, inverse probability, elementary law of probability	10
IV	**Introduction to research methods** : Meaning, objective, types and significance of research methods, research designs, research process and problem **Interpretation and report writing** : Meaning, techniques, precaution and significance of report writing, different steps in writing report, mechanism and precaution of writing a research report	10

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year

1	S. P. GUPTA	STATISTICAL METHODS	SULTAN CHAND & SONS (P) LTD.
2	WAYNE W. DANIEL,	BIOSTATISTICS: A FOUNDATION FOR ANALYSIS IN THE HEALTH SCIENCES	WILEY PUBLISHERS

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 303-21**
Subject Title	**Histopathology and Cytology**
Objective	**To teach basic concepts of Histopathology and Cytology**

Course Contents

UNIT	CONTENTS	HOURS
I	**Introduction and lab organization** : Histopathology lab organization, maintenance of important equipments used in lab **Histological specimens** : Types, transportation, preservation, labeling & fixation, types of fixatives, simple fixatives, compound fixatives, fixatives for special component of tissue **Hormonal assessment** : Introduction, menstrual cycle, and hormonal assessment on PAP smear	12
II	**Tissue processing** : Tissue processing, dehydration and dehydrating media, clearing and clearing agents, embedding and embedding agents, different types of embedding methods, alternative tissue processing method, automated tissue processor, microwave tissue processor, open and closed tissue processor, paraffin embedding station and cryostat, Microtomy, haematoxylin and eosin stain **Electron microscopy and allied techniques** : Preparation of specimen, fixation, tissue processing schedule, ultramicrotomy and knives used for cutting, staining of sections for electron microscopy., frozen section of muscle biopsy.	12
III	**Cytological Staining** : History and types of sample submitted for cytology, collection of various types of samples for cytology, their fixation, cytological preparation with special emphasis on MGG, PAP stain, cytological fixatives, cytological screening and quality control in cytology lab., thinprep 2000, automated slide strainer, automatic coversliper and PAPNET **Immunohistochemistry** : Immunofluorescence, preparation of material, staining, tests for specificity and applications, types of method, blocking of non specific reactive sites, controls, procedure and application, automated slide strainers for IHC	8
IV	**Detection and identification of bacteria, virus, protozoa and fungi** : Gram stain and modified methods, Ziehl Neelsen stain for	8

	mycobacterium tuberculosis, fluorescence method for Mycobaterium tuberculosis, methods for Mycobacterium leprae, cresyl violet acetate and Gimenez method for Helicobacter pylori, Warthin Starry method for spirochetes, Grocott methenamine silver method, McManus PAS method for fungi, demonstration of rickettsia, detection and identification of viruses, demonstration of protozoa and other organisms. **Enzymes** : Fixation, types of enzymes and types of histochemical reactions, methods for specific phosphatases, methods for specific and non-specific esterases, and oxidative enzymes., methods for demonstration of hydrolytic enzymes, specific phosphatases, specific and non-specific esterases	

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	CULLING'S C.F.A. ALLISON R.T. AND BARR W.T., BUTTERWORTH-HEINEMANN	BASIC CELLULAR PATHOLOGY AND ALLIED TECHNIQUE	(ELSEVIER).
2	BANCROFT J. D. AND GAMBLE M,	THEORY & PRACTICE OF HISTOLOGICAL TECHNIQUES	CHURCHILL LIVINGSTONE.

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 304-21**
Subject Title	**Fundamentals of Scientific Writing**
Objective	**To teach basic concepts of Molecular Biology and Genetics**

Course Contents

UNIT	CONTENTS	HOURS
I	**Sources of information** : using and comprehending primary, secondary, tertiary, gray source, citing source, using different editorial styles **Manuscript writing** : Different types of writing – descriptive, comparative, argumentative, covering the role of different editorial styles –American medical association (AMA), modern language association (MLA) and American psychological association (APA).	8
II	**Professional writing** : reviews, critical appraisals of topics, case reports, commentaries and opinion piece, overview of life/health insurance underwriting. **Medical transcript writing** : learning key medical and statistical terms, grammar essentials for medical writers, assistance of computer programmes and websites, basic writing skills, future of medical writing.	10
III	**Issues in scientific writing** : quoting (when to quote, integrating quotations, accurate quoting, punctuating quotations), plagiarism (introduction, how to avoid and implications), critical analysis	8
IV	**Preparation of manuscript** : writing scientific paper and format of an original manuscript, publication process covered by specific journal, different types of journal metrics, authorship, ghostwriting **Introduction to Intellectual Property:** Historical perspectives and need for for the introduction of Intellectual property right, Types of IP; Patents, Trademarks, copyright & related Rights, Industrial Design, Traditional Knowledge, Geographical Indications,Protection of GMOs IP as a factor in R&D, Protection of Plant varieties.	8

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	JANICE R. MATTHEWS	SUCCESSFUL SCIENTIFIC WRITING: A STEP-BY-STEP GUIDE FOR THE BIOLOGICAL AND MEDICAL SCIENCES	CAMBRIDGE UNIVERSITY PRESS
2	VICTORIA E. MCMILLAN	WRITING PAPERS IN THE BIOLOGICAL SCIENCES	BEDFORD BOOKS LTD

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 305-21**
Subject Title	**Microbial Biotechnology and Quality Assuarance**
Objective	**To teach basic concepts of Applied Medical Microbiology and Quality Assuarance**

Course Contents

UNIT	CONTENTS	HOURS
I	**Recombinant DNA technology** : Integration of DNA insert into the vector, introduction of recombinant DNA into a suitable host, integration of DNA inserts through site specific recombination, selection of the desired recombinant clones, selection of clones containing recombinant DNA, selection of the clone containing a Specific DNA inserts. **Expression of recombinant proteins** : Production of recombinant proteins in E.coli, transcriptional , translational fusions, runaway plasmid, production of recombinant proteins in other organisms, production of recombinant proteins in other microorganism	10
II	**Gene Cloning** : Steps in gene cloning, restriction endonucleases, recognition sequences, modification of cut ends, other enzymes used in cloning, properties of good vectors, E.coli vectors, bacteriophage vectors, cosmid vectors, phagemid vectors, phasmid vectors, artificial chromosome vectors, cloning and expression vectors, shuttle vectors, yeast vectors, complementary DNA library, isolation of desired gene, identification of desired clone, problems in cDNA preparation, genomic library.	10
III	**Molecular Techniques** : Chemical Synthesis of Gene, gene amplification through PCR, variations of PCR, applications,limitations	8

	and advantages of PCR,RFLP,RAPD and AFLP **Automation** : BACTEC, Vitek 2, Microscan walkaway, Phoenix, Sensititre Aris 2X, use of MALDI-TOF for microbial identification (Vitek MS).	
IV	**Quality Control and assuarance** : Introduction, quality assurance, specimen collection, preservation and transport, levy-jennings chart, internal and external quality control, Clinical Establishment Act Standard for Medical (Clinical) Laboratory, in vitro diagnostic (IVD) regulation, professionalism, ethical responsibility and code of conduct. **Biosafety:** Introduction, Historical Background; Introduction to Bio-safety cabinets; Primary contaminant for biohazards, Biosafety levels of specific microorganisms,; Recommended biosafety levels for infectious agents, Biosafety committee composition and role of biosafety committee.	8

Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	B D SINGH	BIOTECHNOLOGY:EXPANDING HORIZONS	KALYANI PUBLISHERS
2	S B PRIMROSE AND R M TWYMAN	PRINCIPLES OF GENE MANIPULATION AND GENOMICS	BLACKWELL SCIENCE LTD.

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 306-21**
Subject Title	**Virology and Mycology Lab**
Objective	**To learn the basic skills and practical knowledge of Virology and Mycology Lab**

Details of the Course

CONTENTS
Serodiagnosis • To perform serodiagnosis of HIV infection by tridot kit • To perform serodiagnosis of hepatitis B infection by cassette method • To perform serodiagnosis of hepatitis C infection by cassette method • To perform serodiagnosis of hepatitis A infection by cassette method • To perform serodiagnosis of hepatitis E infection by cassette method **Staining** • To perform staining of fungi by lactophenol cotton blue • To perform staining of fungi with 10% and 40% KOH **Identification of Fungi** • To isolate and identify the fungi from soil sample • To isolate and identify the fungi from nail sample • To isolate and identify the fungi from skin sample • To isolate and identify the fungi from hair sample • To isolate and identify Candida sp. and perform germ tube test **Slide Culture technique** • To perform slide culture technique for studying morphology of mould

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY	
Course Name	**M.Sc. Medical Microbiology**
Subject Code	**MMB 307-21**
Subject Title	**Histopathology and Cytology Laboratory**
Objective	**To learn the basic skills and practical knowledge of Histopathology and Cytology Laboratory**

Details of the Course

CONTENTS
Histology specimen • To receive/gross the histological specimen. **Tissue processing** • To process the tissue for embedding. **Section cutting** • To perform the tissue cutting. **Alternative processing** • To process a tissue using chloroform and acetone **Routine stain** • To perform haematoxylin and eosin stain. **PAP stain** • To prepare and stain the buccal smear using PAP stain. **Cytological stain** • To perform MGG stain. **Bacterial stain** • To perform Gram's stain on tissue. **Acid fast stain**

• To perform Z-N stain on tissue.

Metal impregnation

• To perform Grocott's methenamine silver method

PAS stain

• To prepare the reagents and perform the periodic acid schiff's stain on paraffin section

• Congo red stain

THIRD SEMESTER

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
MMB-301-21	Core theory	Virology and Mycology	4	0	0	30	70	100	4
MMB-302-21	Core theory	Biostatistics	3	1	0	30	70	100	4
MMB-303-21	Core theory	Histopathology and Cytology	3	1	0	30	70	100	4
MMB-304-21	Core theory	Fundamentals of Scientific Writing	3	1	0	30	70	100	4
MMB-305-21	Elective theory	Microbial Biotechnology and Quality Assurance	3	0	0	30	70	100	3
MMB-306-21	Core practical/ laboratory	Virology and Mycology Laboratory	0	0	4	25	75	100	2
MMB-307-21	Core practical/ laboratory	Histopathology Laboratory	0	0	4	25	75	100	2
MMB-308-21	Core practical/ laboratory	Minor Project (Bioinformatics and Biostatistics)	0	0	2	25	75	100	1
MMB-309-21	Elective practical	Seminar/ workshops	0	0	2	---	---	100	1
	TOTAL		16	3	12	225	575	900	25

FOURTH SEMESTER

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		

MMB-401-21	Core Practical	Dissertation/Medical Microbiology Training	4	0	0	30	70	100	4